

REMARKS

Claims 1-17 are pending in the present application.

The rejection of Claim 1 under 35 U.S.C. §102(b) over Menegoli (U.S. Patent No. 6,133,107) is respectfully traversed.

The present invention provides, *inter alia*, a semiconductor substrate comprising:

a lightly doped substrate that contains impurities at a low concentration;  
a heavily doped diffusion layer entirely covers a top of the lightly doped substrate and is higher in impurity concentration than the lightly doped substrate; and  
an epitaxial layer which entirely covers a top of the heavily doped diffusion layer and contains impurities at a lower concentration than the heavily doped diffusion layer (see Claim 1).

From the foregoing, Applicants submit that it is clear that the semiconductor substrate of the present invention is formed of three superposed layers, i.e., a lightly doped substrate, a heavily doped diffusion layer and an epitaxial layer. The heavily doped diffusion layer entirely covers a top of the lightly doped substrate, and the epitaxial layer entirely covers a top of the heavily doped diffusion layer.

The Examiner cites Menegoli in rejecting Claim 1 and alleges that “Referring to figures 12-14, Menegoli *teaches* a semiconductor substrate comprising:

a lightly doped substrate (50, P-) that contains impurities at a low concentration (see figure 12, col. 4, lines 66-67);

a heavily doped diffusion layer (54, N+, see figure 12, col. 5, lines 3-10) which entirely a top of the lightly doped substrate (50) and is higher in impurity concentration than the lightly doped substrate (see col. 4, lines 66-67, col. 1-10); and

an epitaxial layer (60, col. 5, lines 22-26) which entirely covers a top of the heavily doped diffusion layer and contains impurities at a lower concentration than the heavily doped diffusion layer (see figure 12, col. 5, lines 22-26).”

In making this rejection, the Examiner alleges that Figures 12-14 do show that the diffusion layer (54) does “entirely” cover the lightly doped substrate (50) (see page 7, lines 1-4 of the Office Action mailed August 10, 2007). Applicants again submit that Figures 12-14 are merely different cross-sectional views of Figures 6-11 and, as such, must be considered as a whole. The interrelatedness of Figures 6-11 is explicit in Menegoli at column 4, lines 63-65, which state: “A method for constructing an N channel DMOS transistor according to a first embodiment of the invention is shown in FIGS. 4-16” (see also column 4, lines 48-50). The Examiner does not even address this argument in the outstanding Office Action.

Applicants further submit that in contrast to Examiner’s allegation, Menegoli does not disclose the semiconductor substrate of the present invention. In fact, Menegoli does not disclose an invention relating to a semiconductor *per se*, but rather Menegoli disclose an invention relating to a semiconductor integrated circuit.

The Examiner refers to Fig. 12 of Menegoli as disclosing the claim feature of a “heavily doped diffusion layer which entirely covers a top of the lightly doped substrate and is higher in impurity concentration than the lightly doped substrate” as recited in claim 1. However, this assertion of the Examiner is improper, since Fig. 12 as well as Figs. 13 and 14 show only a restricted portion of a semiconductor circuit device in a large scale, and thus, these figures cannot show a “heavily doped diffusion layer which *entirely* covers a top of the

lightly doped substrate and ...” (*emphasis added*). In this regard, at column, 6, line 10, Menegoli states that “As shown in Fig. 12, *at a large scale than prior figures, ...*” (*emphasis added*).

The Examiner’s attention is further directed to Figs. 10 or 11 (these figures show a larger portion of the semiconductor substrate than Figs. 12-14) for a better view of the semiconductor substrate of Menegoli. Reviewing Fig. 10, for example, it is clearly understood that the heavily doped N+ layer (54) is formed selectively, not entirely, in the semiconductor substrate. In this regard, column 5, line 1-5 of Menegoli recites “[a] mask 52, preferably containing nitride, is formed on the surface of the substrate 50 and is patterned to create a dopant introduction window 53. *An N+ type buried region 54 is formed in the substrate 50 through the dopant introduction window 53*” (*emphasis added*). See also Fig. 4.

The foregoing disclosure by Menegoli also makes clear that the heavily doped N+ layer (54) is selectively, not entirely, formed on the semiconductor substrate. In fact, as shown in, for example, Fig.10, heavily doped N+ layer is not formed on the portion of the semiconductor substrate, which is between P+ type buried region (58) and the heavily doped N+ layer (54). In other words, the heavily doped diffusion layer (54) does not entirely cover the semiconductor substrate (50) as presently claimed.

Accordingly, the heavily doped N+ layer (54) does not correspond to the claimed feature of a “heavily doped diffusion layer which *entirely* covers a top of the lightly doped substrate ...”, as recited in claim 1, and thus Menegoli does not disclose the feature of a “heavily doped diffusion layer which *entirely* covers a top of the lightly doped substrate ...”, as recited in claim 1. The Examiner is reminded that in order for a reference to anticipate an invention, the reference “must teach every element of the claim” (MPEP §2131). As such, Applicants submit that Menegoli fails to anticipate the claimed invention.

In view of the foregoing, Applicants request withdrawal of this ground of rejection.

The rejection of Claims 2-5 under 35 U.S.C. 103(a) over Menegoli (U.S. Patent No. 6,133,107) in view of the applicants alleged admission of the Prior Art on pages 1-4 of the present specification and further in view of Werner (U.S. Patent No. 6,469,365) is respectfully traversed.

Menegoli is discussed above and each fails to disclose or suggest a semiconductor substrate meeting the limitations of independent Claim 1. The Examiner further acknowledges that Menegoli do not disclose the lightly doped substrate contains phosphorous or boron, the resistance of the epitaxial layer is 10  $\Omega$ cm or less, and the lightly doped substrate and the heavily doped diffusion layer are of a first conductivity type, and the epitaxial layer is of a second conductivity type.

Thus, the Examiner cites the alleged admission of the Prior Art on pages 1-4 of the present specification and Werner as showing that lightly doped substrates contain phosphorus or boron and that the resistance of the epitaxial layer is 10  $\Omega$ cm or less.

However, as described with regard to the rejection of claim 1, Menegoli fail to disclose or suggest the claim limitation of a “heavily doped diffusion layer which *entirely* covers a top of the lightly doped substrate and ... .” Neither the alleged admission of the Prior Art on pages 1-4 of the present specification nor Werner cures the deficiency of Menegoli. Thus, Claims 2-5 are not obvious over the cited references. Furthermore, Claims 2-5 ultimately depend upon Claim 1. Accordingly, Claims 2-5 are patentable over the references due to at least the claim dependency from Claim 1.

According, withdrawal of this ground of rejection is requested.

With respect to the non-elected method claims, Applicants remind the Examiner that MPEP §821.04 states:

...if applicant elects claims directed to the product, and a product claim is subsequently found allowable, withdrawn process claims which depend from or otherwise include all the limitations of the allowable product claim will be rejoined.

Accordingly, upon a finding of allowability of the elected product claims, Applicants respectfully request rejoinder of the withdrawn process claims that depend therefrom.

Finally, with respect to the elected species in response to the Election of Species Requirement mailed April 19, 2007, Applicants respectfully submit that, should the elected species be found allowable, the Office should expand its search to the non-elected species.

Applicants submit that the present application is now in condition for allowance. Early notice to this effect is earnestly solicited.

Respectfully submitted,

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